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Abstract

Objective: To describe the use of prescribed contraceptives in Northern Ireland (NI) and how this varies with a woman's age, the deprivation in the area in which she lives and characteristics of her General Practice (GP).

Method: A population-based cohort study was conducted including 560,074 females, aged 12-49 registered with a GP (2010-2016), contributing 3,255,500 woman-years of follow-up. Dispensed contraceptive prescriptions were linked to demographic details.

Results: A contraceptive prescription was dispensed in 26.2% of woman-years with women aged 20-24 most likely to have a contraceptive dispensed (45.7% of woman-years). After adjusting for patient and other practice characteristics, practices in the least deprived quintile prescribed 6% more contraception than those in the most deprived quintile. The combined oral contraceptives (16.6% of woman-years) and progesterone only pill (8.0% of woman-years) were the most commonly dispensed methods. Patient and practice level characteristics were found to be related to the specific contraceptive methods dispensed which also changed during the time frame of the study.

Conclusions: This is the first population-based assessment of contraceptive prescription in NI. It is useful for health service planning and to inform broader reproductive policy debates. The impact of practice area-based deprivation, above that of the woman's residence, on contraceptive dispensing is a new finding that deserves more exploration.

Keywords: contraception, medication utilisation, prescription database, administrative data, data linkage, population-based cohort

Introduction

Northern Ireland (NI) has been in a unique position in the United Kingdom (UK) as until recently abortion was only legal under very limited circumstances [1]. The risk of an unintended, potentially unwanted, pregnancy is related to whether or not a woman and her partner use any method of contraception and which method they use [2]. It is important that contraceptive advice and provision is addressed as part of the policy and legal reform now ongoing regarding abortion.

A 2014 survey by the Family Planning Association found that half of sexually active women in NI had had unprotected sex in the previous two years [3]. The most commonly used contraceptive methods in NI in the 2014/15 Health Survey were the combined oral contraceptive (CoC)/Progestogen only pill (PoP) (34%) and male condom (19%) [4]. These methods have some of the highest failure rates [5], due to their need for consistent and correct use [6]. Studies of contraceptive use in GB (which excludes NI) and Ireland have found that contraceptive use is sociodemographically patterned. Women with lower levels of education [7,8], in the low and middle social classes and those living in the most disadvantaged areas are less likely to use contraception than their more advantaged peers [7]. Contraceptive pill users are younger and more likely to be unmarried [8,9] while long-acting reversible contraceptives (LARC), which have much lower failure rates than other methods, are used by older women [10] and those living in more deprived areas [11,12]. We do not know if, or how, contraceptive use in NI varies by age or deprivation. Information on the use of contraception in NI would inform the broader reproductive policy debate, make it possible to identify any areas of need and aid with health service planning [13].

In NI, the Honest Broker Service (HBS) facilitates research using routinely collected administrative health datasets. This includes all prescriptions dispensed to the

NI population since 2010. Through the HBS this project aimed to describe the use of prescribed contraceptives in NI and explore how this varies according to a woman's age and the deprivation in the area in which she lives. As the prescriber plays a critical role in determining medication use we also explored how the use of prescribed contraceptives varies based on characteristics of the woman's general practice (GP) including size of practice, urban/rural location and practice area deprivation.

Materials and methods

A population-based cohort study was conducted, through the HBS, using the Enhanced Prescribing Database (EPD) and GP Patient Registrations Index 2010-2016. The GP Patient Registrations Index records demographic details of patients registered with each GP in NI. The EPD includes drugs dispensed in primary care that have been submitted to the health service for payment. The information recorded includes substance, date dispensed and prescriber. Only prescriptions that are subsequently dispensed and which can be liked to a patient are included in the dataset. During the first three months of this study patients in NI paid a nominal charge for each prescription dispensed. All prescriptions were free from April 2010 [14].

The EPD and GP Patient Registrations Index were linked using the patient Health and Care Number. The NI Multiple Deprivation Measure 2017 (NIMDM2017) quintile for the super output area in which the patient lived on January 1st each year was added based on their postcode of residence. The NIMDM2017 is the official measure of deprivation in NI and ranks areas based on 7 types or 'domains' of deprivation: Income Deprivation, Employment Deprivation, Health Deprivation and Disability, Education, Skills and Training Deprivation, Access to Services, Living Environment and Crime & Disorder [15,16]. For each practice a NIMDM2017 quintile and urban/rural location was allocated based on the practice address in 2017. A small number of practices

(16/359, 4.5%) did not exist in 2017, due to practice closures or mergers, and for these practices the urban/rural location, NIMDM2017 quintile and practice size was based on 1st January 2010 address or practice population.

All women aged 12-49 years inclusive registered with a GP in NI between 2010 and 2017 were included. Women entered the cohort at the beginning of the study window, on the 1st of January the year they turned 12 or on the 1st January the year they first registered with a GP in NI. Women remained in the cohort until the end of the study observation period, they reached age 50 or were no longer registered with a GP in NI on the 1st January. A change in registered GP did not affect inclusion. Prescribing data for each year was included in the dataset only if the woman was registered with a GP on the 1st of January that year and on the 1st January in the subsequent year. If a woman left the GP register but then returned to it those years where she met the inclusion criteria were included.

The annual percent prevalence of dispensed prescriptions for any, and the different methods of contraception, were determined for each calendar year between 2010 and 2016. Contraceptive prescriptions were recorded under the British National Formulary chapter 7, section 3 and chapter 21, section 4. The following types of contraceptive were explored: any contraceptive, CoC, PoP, emergency contraceptive (EC), injection, implant, intra uterine device/system (IUD/S), transdermal patch, vaginal ring and gel. Use of the cap or diaphragm was rare and so was not explored. As a woman may use more than one type of contraceptive in any year, she may contribute to the prevalence of more than one type of contraceptive in any year. Age was measured on the 1st January each year.

Descriptive statistics were used as appropriate. Comparisons in the prevalence of use of any, and the different methods of contraceptive, across patient and GP

characteristics were made using generalised estimating equations (GEE), with robust standard errors based on the sandwich estimator. GEE were used to account for the longitudinal nature of the data and clustering of women in GP practices. Age (<16, 16-19, 20-24, 25-29, 30-34, 35-39, 40-44 and 45+ years), patient address NIMDM2017 deprivation quintile (1 most deprived - 5 least deprived), practice size (0-2,500; 2,501-5,000; 5,001-7,500; 7,501-10,000 and 10,000+ registered patients (male and female), practice urban/rural location and practice address NIMDM2017 deprivation quintile were included as categorical covariates. Categories were combined when necessary, to prevent disclosure, if use of a contraceptive was rare. For each analysis, the details of the prescribing practice were used, even if this was not the practice the woman was registered with on the 1st of January that year. Data are presented as adjusted prevalence rate ratios (aRR) with 95% confidence intervals (CI). The largest category was used as the reference group except for year (where 2010 was used) and age (where 20-24 was used). All analyses were undertaken using Stata version 13 [17].

In large database studies, small differences between groups may have very narrow and non-overlapping confidence intervals (or "significant" *p* values) due to the number of observations. It is then up to the investigator and the reader to impose their own perspective to determine the meaningfulness of differences that can be estimated with such high precision in large databases [13]. We chose to limit our interpretation to differences of 5% or more.

The cohort included 560,074 women registered in 359 general practices 2010-2017. Total follow-up was 3,255,500-woman-years with the mean follow-up of individual women 5.8 years. Women were registered with 1-6 GPs during the period with practices having 346-5,758 women who met the inclusion criteria registered with them.

Ethics approval

This study was approved by Ulster University Nursing and Health Research Ethics Filter Committee.

Results

Between 2010 and 2016, in 26.2% of women years there was a contraceptive prescription dispensed, see Figure 1. CoC's were the most commonly dispensed (16.6% of woman-years) followed by the PoP (8.0% of woman-years). Prescribing of other contraceptive methods was rarer with the EC dispensed in 1.5% of woman-years, the injection in 1.0%, the implant in 0.8%, the IUD/S in 0.6%, patches in 0.3% and the vaginal ring and gel dispensed in 0.02% and 0.004% of woman-years respectively. Supplemental Table 1 provides more detail on the hormonal content of CoC, PoP and IUD/S prescriptions.

Between 2010 and 2016, dispensing of any contraception remained stable (Table 1, Figure 2) but the contraceptive methods dispensed varied (Supplemental Table 1, Figure 2). After adjustment, there was a 12% reduction in dispensing of the CoC (aRR 0.88, 95% CI 0.88-0.89), a 6% reduction in the contraceptive injection (aRR 0.94, 95% CI 0.92-0.95) and a 5% reduction in the EC (aRR 0.95, 95% CI 0.93-0.96), in 2016 compared to 2010. Conversely, there was a 23% increase in dispensing of the PoP (aRR 1.23, 95% CI 1.22-1.24), a 12% increase in the contraceptive implant (aRR 1.12, 95% CI 1.11-1.14) and a 6% increase in the IUD/S (aRR 1.06, 95% CI 1.04-1.09).

Forty-six percent of women of 20-24 years had a contraceptive dispensed, the highest proportion of any age group (see Figure 3, Supplemental Table). Those 12-16 were least likely to have a contraceptive dispensed (6.8% of woman-years), followed by those 45-49 years old (8.5% of woman-years). Dispensation of the CoC followed a

similar pattern by age to that for any contraceptive. Dispensation of the PoP showed less age variation and was most common in the 35-39 age group. The PoP was the most common method of contraception for women over 40. Of the less common methods, EC, injection and patches were most common in the 20-24 age group, implant in the 16-19 age group, IUD/S in the 35-39 age group, vaginal ring in 25-29 age group and gel in the 45-49 age group. The age patterning of dispensed contraception was the same after adjustment for other patient and GP practice characteristics (Supplemental Table).

After adjustment for age and other variables, there was little variation in dispensing of any contraception with the deprivation in the area in which a woman lived (Table 1). The contraceptive methods dispensed did vary with area deprivation (Table 2). In the least deprived quintile, EC was dispensed 20% less (aRR 0.80, 95% CI 0.78-0.81), the injection 12% less (aRR 0.88, 95% CI 0.85-0.90), patch 11% less (aRR 0.89, 95% CI 0.85-0.94) and PoP 7% less (aRR 0.93, 95% CI 0.92-0.95) compared to the most deprived quintile. Conversely there was 5% greater dispensing (aRR 1.05, 95% CI 1.04-1.07) of the CoC in the least deprived quintile compared to the most deprived quintile.

There was no difference in dispensing of any contraceptive by practice urban/rural location (Table 1) but the contraceptive methods dispensed did vary (**Error! Reference source not found.**). After adjustment, rural practices prescribed 20% more of the IUD/S (aRR 1.20, 95% CI 1.18-1.21), 15% more of the implant (aRR 1.15, 95% CI 1.13-1.16), 9% more of the patch (aRR 1.09, 95% CI 1.06-1.13) and 5% more of the CoC (aRR 1.05, 95% CI 1.04-1.05) than urban practices. Rural practices prescribed 6% less PoP (aRR 0.94, 95% CI 0.93-0.95) and 7% less EC (aRR 0.93. 95% CI 0.92-0.94) than urban practices.

There was little variation in prescribing of any contraception with practice size (Table 1) but the contraceptive method prescribed did vary (**Error! Reference source not found.**). There was a trend for increased prescribing of the CoC and injection with decreasing practice size with 7% more CoC (aRR 1.07, 95% CI 1.05-1.08) and 11% more of the injection (aRR 1.11, 95% CI 1.07-1.15) prescribed in the smallest practices (0-2,500 patients) when compared to practices with 7,501-10,000 patients. The reverse of this trend was seen for the IUD/S with smaller practices prescribing 24% less (aRR 0.76, 95% CI 0.73-0.79) of the IUD/S.

Those practices in the least deprived areas were 6% more likely to prescribe contraception than those in the least deprived areas (aRR 1.06, 95% CI 1.05-1.07) (Table 1). After adjustment, practices in the least deprived quintile prescribed 19% less of the implant (aRR 0.81, 95% CI 0.79-0.83), 16% less of the transdermal patch (aRR 0.84, 95% CI 0.79-0.89) and 9% more of the PoP (aRR 1.09, 95% CI 1.08-1.11) than those in the most deprived quintile (**Error! Reference source not found.**).

Discussion

Findings and interpretation

Any prescribed contraception

This is the first population-based study to explore contraceptive use in NI. Previous estimates of contraceptive use were based on small survey samples [4,18,19] and limited by inherent reporting (social acceptability and recall) bias [20]. Such bias can result in under or over-reporting of sensitive sexual behaviours [13,20,21] but will not have affected estimates of prescribed contraceptive use based on dispensed prescription records. In keeping with GB and Ireland, we found that just over a quarter of women of reproductive age were dispensed prescribed contraceptives in any one year [9,22–24].

Those aged 20-24 had the most contraception dispensed, as might be expected from the pattern of sexual activity and pregnancy avoidance in this age group [22,23,25]. Those less than 16 were least likely to have a contraceptive dispensed, with the CoC and PoP the most frequently dispensed. There was no information available on indication for use but 40% of hormonal contraceptive use among adolescents in the UK has been reported to be for management of menstrual symptoms rather than contraception [26,27].

Prior research found that women with lower levels of education [7,8,28,29], lower social class [7] and Medicaid recipients [29] were less likely to use contraception. We found no relationship between dispensation of prescribed contraception and the deprivation in the area in which a woman lived. However, after adjustment for patient and other practice characteristics, practices operating in the least deprived quintile prescribed 6% more contraception. An effect of practice area-based deprivation on contraceptive use has not been reported before. Less dispensing of contraception to women attending practices in the more deprived areas increases their risk of unintended pregnancy and is of concern.

Contraceptive method

In keeping with GB and Ireland, the CoC and PoP were the most commonly dispensed methods of contraception [4,9,22,24]. Over the period examined there was a decrease in dispensation of the CoC in favour of an increase in the PoP. A similar increase in use of the PoP has been seen in Scotland (2005-2009) and is thought to be due to the introduction of newer preparations with advantages over earlier versions [22,30]. While there appears to be a shift away from oestrogen confining hormonal contraceptives these methods do provide non-contraceptive benefits such as improved menstrual symptoms and acne [31]. Indeed, the CoC was still the overwhelmingly preferred choice for younger women while those in the older age groups, who may have

contraindications to the CoC [31,32], were dispensed the PoP. As seen with higher educational level in the USA [33–35], women living in areas of less deprivation were more likely to have the CoC dispensed and less likely to be dispensed the injection and PoP than those living in the more deprived areas. In contrast practices in the less deprived areas prescribed more of the PoP supporting the finding that the deprivation in the area in which a woman's GP practice is based contributes to her prescribed contraceptive use above that of the area in which she lives.

Not all use of the EC will have been identified as it can be bought from pharmacies without a prescription and is dispensed directly by some sexual health clinics. In the NI 2014/15 Health Survey just over a third (36%) of female respondents 16-54 years old who used EC obtained it form a doctor or nurse at a GP surgery [4]. Based on this an estimate of the true use of EC during this period would be about 4%, in keeping with the 3.6% seen in the third British National Survey of Sexual Attitudes and Lifestyles [36]. A decrease in dispensed prescriptions for the EC has been seen in Scotland (2010-2016) [22] and reflects an increase in sales of the EC from community pharmacies [22]. Indeed, there is evidence that use of EC is increasing in GB with the greatest increase among women using retail outlets (eight fold increase 2000-2010) [36]. This increase in use was greatest in less affluent areas, single women and women using less effective methods of contraception [36]. The increase is worrying as EC can be considered a marker of risky sexual behaviour, indicating exposure to unprotected sex or a failure in contraceptive method [36].

Some women will have been obtaining effective contraception from an IUD/S or implant inserted in previous years. This explains the lower rate of use of the IUD/S seen compared to the 2014/15 Health Survey [4]. While dispensation of LARC methods was low, dispensation of the implant and IUD/S has been increasing, as seen in the USA

[34], GB [22,37] and Ireland [38]. Dispensation of the contraceptive injection has been decreasing which may reflect its side effect profile and shorter duration of action, relative to other LARC methods [39,40]. There was evidence that the historical reluctance to use the IUD/S in nulliparous women [41–43] persists in NI with the IUD/S dispensed most to 30-35 year olds while younger women using LARC received the injection and implant. Practice size and location also impacted on choice of LARC method with smaller practices prescribing more of the contraceptive injection and rural practices prescribing more of the IUD/S and implant than urban practices. The National Institute of Health and Care Excellence LARC guideline [44] recommends that IUD/S's are only inserted and removed by trained healthcare professionals who insert at least one IUD/S a month. Smaller practices will therefore not have enough patients requesting an IUD/S to warrant staff training in their insertion [42], or to maintain the skill [45]. Sexual health clinics, which are known to prescribe more LARC methods [12], tend to be situated in urban areas [46] and urban practices may be referring patients to sexual health clinics for LARC [12,22] while rural practices do not have this option. It is clear however, that the LARC method a woman receives from general practice in NI will depend on her age, the size and urban/rural location of her practice.

Strength and Weaknesses

This study does not cover all contraceptive use, as it is restricted to prescribed and dispensed methods only. Contraception provided without a prescription in sexual health clinics, purchased from pharmacies/shops (e.g. condoms and EC) and sterilisation procedures are not included. There will also have been some degree of underestimation of contraceptive use, as patient information is not captured for all prescriptions in the EPD. However, over the period 89% of prescribed and dispensed items were successfully linked to a patient.

Reliance on dispensed prescription records may however overestimate the actual use of prescribed contraceptives as redemption of a prescription does not guarantee the contraceptive was actually used [13]. Dispensation information is however a more accurate measure of drug exposure than data on prescriptions written as prescriptions written by doctors are not always filled by patients [47].

There was no information on sexual activity, duration and type of relationship [23], ethnicity [29,48] or religion [35] which have been shown to be related to contraceptive use.

Open questions and future research

The finding that practice area-based deprivation, and not that of the area in which a woman lives, was related to whether she had any contraception, and the PoP, dispensed needs further exploration. The NIMDM2017 is an area-based measure of deprivation and it would be of interest to relate contraceptive dispensing to a measure of the woman's individual socioeconomic position. Practice level factors such as distance to the nearest sexual health clinic and prescriber characteristics would also be of interest. Attitudes on efficacy and safety of different contraceptive methods have for example been shown to be related to role (doctor/nurse), gender and age [42].

Access to sexual health clinic and pharmacy data would provide further insight into provision of contraception in NI, in particular EC and LARC [12]. At present, it is not possible to determine if women living in less deprived areas truly use less of the EC or if instead, they buy the EC, rather than request a prescription. The same may be true for those living in rural communities where pharmacies and sexual health clinics offer anonymity compared to general practice.

Unrealistic expectations, media scares and a lack of awareness of non-contraceptive benefits can make the adoption of effective birth control methods a

challenge [49]. A piece of qualitative work exploring awareness of, and attitudes to, prescribed contraceptive methods, among women and GPs in NI, would be useful to provide insight into the changing use of CoC/PoP and low levels of use of parenteral methods of contraception, such as the LARC, patch, ring and gel.

Conclusion

This is the first population-based assessment of contraceptive prescription in NI and it will be useful to inform reproductive policy debate and health service planning. Patient and practice level characteristics were found to be related to the specific contraceptive methods dispensed which also changed during the short time frame of the study. The new finding that dispensation of contraception was related to practice area-based deprivation, and not that of the woman's residence, deserves more exploration.

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Disclosure of interest

The authors report no conflict of interest.

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Table 1 Number, percent of woman-years, crude and adjusted prevalence rate ratios for dispensation of any contraceptive by year, age group, woman's residence area-based deprivation quintile, General Practice urban/rural location, practice size and practice area-based deprivation quintile

		n (%)	Crude RR (95% CI)	Adjusted RR (95% CI)
Year	**2010**	116,478 (25.7)	Ref.	Ref.
	2011	119,552 (26.2)	1.01 (1.00-1.01)	1.01 (1.01-1.02)
	2012	121,823 (26.5)	1.01 (1.01-1.02)	1.02 (1.02-1.03)
	2013	122,127 (26.3)	1.00 (1.00-1.01)	1.01 (1.01-1.02)
	2014	122,746 (26.2)	1.00 (0.99-1.00)	1.01 (1.01-1.02)
	2015	124,596 (26.3)	1.00 (0.99-1.00)	1.02 (1.01-1.02)
	2016	125,256 (26.1)	0.99 (0.98-0.99)	1.01 (1.00-1.01)
Age group	**<16**	20,822 (6.8)	0.30 (0.30-0.30)	0.3 (0.30-0.30)
	16-19	105,843 (35.6)	0.80 (0.80-0.81)	0.8 (0.80-0.81)
	20-24	181,590 (45.7)	Ref.	Ref.
	25-29	183,056 (41.5)	0.90 (0.90-0.91)	0.9 (0.90-0.91)
	30-34	147,821 (33.2)	0.72 (0.72-0.73)	0.72 (0.72-0.73)
	35-39	102,629 (23.8)	0.56 (0.55-0.56)	0.56 (0.55-0.56)
	40-44	70,404 (15.3)	0.43 (0.42-0.43)	0.43 (0.42-0.43)
	45+	40,413 (8.5)	0.33 (0.33-0.34)	0.33 (0.33-0.34)
Woman's address NIMDM2017 Quintile	**1 – most deprived**	185,050 (27.5)	Ref.	Ref.
	2	178,988 (26.9)	0.99 (0.98-1.00)	1.00 (0.99-1.01)
	3	172,774 (26.3)	0.97 (0.96-0.98)	0.99 (0.98-1.00)
	4	164,862 (25.3)	0.95 (0.95-0.96)	0.98 (0.97-0.99)
	5 – least deprived	140,539 (24.8)	0.94 (0.94-0.95)	0.98 (0.97-0.99)

	Missing[1]	10,365 (26.5)	-	-
Practice urban/rural	**Rural**	204,384 (26.5)	1.02 (1.01-1.02)	1.02 (1.01-1.03)
	Urban	648,194 (26.1)	Ref.	Ref.
Practice size	**0 to 2,500**	34,483 (26.6)	1.02 (1.00-1.03)	1.01 (0.99-1.02)
	2,501 to 5,000	223,637 (27.0)	1.03 (1.03-1.04)	1.03 (1.03-1.04)
	5,001 to 7,500	230,064 (26.2)	1.01 (1.00-1.02)	1.01 (1.00-1.02)
	7,501 to 10,000	228,387 (25.8)	Ref.	Ref.
	Over 10,000	136,007 (25.5)	1 (0.99-1.01)	0.98 (0.98-0.99)
Practice address NIMDM2017 Quintile	**1 – most deprived**	299,366 (25.8)	Ref.	Ref.
	2	195,391 (26.7)	1.03 (1.02-1.04)	1.05 (1.04-1.05)
	3	139,746 (26.0)	1.01 (1.00-1.02)	1.04 (1.03-1.05)
	4	149,798 (27.0)	1.05 (1.04-1.06)	1.06 (1.05-1.07)
	5 – least deprived	68,277 (25.3)	1.00 (0.99-1.01)	1.06 (1.05-1.07)

[1] This is the only variable with missing information

Table 2 Number, percent of woman-years and adjusted prevalence rate ratios for contraceptive methods dispensed across the woman's residence area-based deprivation quintiles

Contraceptive	Woman's address NIMDM2017 Quintile										
	1 Most deprived		2		3		4		5 Least deprived		Missing
	n (%)		n (%)	Adj. RR (95% CI)	n (%)	Adj. RR (95% CI)	n (%)	Adj. RR (95% CI)	n (%)	Adj. RR (95% CI)	n (%)
CoC	113,577 (16.8)	Ref.	111,087 (16.7)	1.01 (1.01-1.02)	111,092 (16.9)	1.02 (1.01-1.03)	106,525 (16.3)	1.03 (1.02-1.04)	926,27 (16.3)	1.05 (1.04-1.07)	6,920 (17.7)
PoP	57,86 (8.6)	Ref.	54,655 (8.2)	0.97 (0.96-0.98)	52,253 (7.9)	0.96 (0.95-0.98)	50,354 (7.7)	0.94 (0.93-0.95)	43,954 (7.8)	0.93 (0.92-0.95)	2,734 (7.0)
Emergency	13,516 (2.0)	Ref.	11,244 (1.7)	0.95 (0.93-0.96)	9,677 (1.5)	0.9 (0.89-0.91)	8,370 (1.3)	0.86 (0.85-0.87)	5,710 (1.0)	0.80 (0.78-0.81)	627 (1.6)
Injection	8,341 (1.2)	Ref.	7,598 (1.1)	0.97 (0.94-0.99)	5,869 (0.9)	0.91 (0.89-0.93)	5,813 (0.9)	0.91 (0.89-0.93)	3,970 (0.7)	0.88 (0.85-0.90)	379 (1.0)
Implant	6,799 (1.0)	Ref.	7,005 (1.1)	1.03 (1.02-1.05)	5,698 (0.9)	0.99 (0.97-1.00)	4,435 (0.7)	0.93 (0.92-0.95)	2,377 (0.4)	0.83 (0.81-0.85)	388 1.0)
IUD/S	3,080 (0.5)	Ref.	4,567 (0.7)	1.09 (1.07-1.11)	4,166 (0.6)	1.06 (1.04-1.08)	3,802 (0.6)	1.02 (1.00-1.04)	2,887 (0.5)	0.97 (0.95-0.99)	250 (0.6)
Patch	2,533 (0.4)	Ref.	1,989 (0.3)	0.97 (0.93-1.01)	1,523 (0.2)	0.94 (0.90-0.97)	1,232 (0.2)	0.91 (0.87-0.95)	814 (0.1)	0.89 (0.85-0.94)	121 (0.3)
Vaginal Ring	175 (0.0)	Ref.	157 (0.0)	0.97 0.89-1.05)	115 (0.0)	0.92 (0.84-1.02)	164 (0.0)	0.93 (0.84-1.03)	115 (0.0)	0.91 (0.81-1.03)	10 (0.0)
Gel	25 (0.0)	Ref.	26 (0.0)	1.01 0.84-1.22)	21 (0.0)	0.98 (0.83-1.16)	40 (0.0)	1.09 (0.88-1.35)	18 (0.0)	0.82 (0.66-1.03)	0 (0.0)

Figure 1

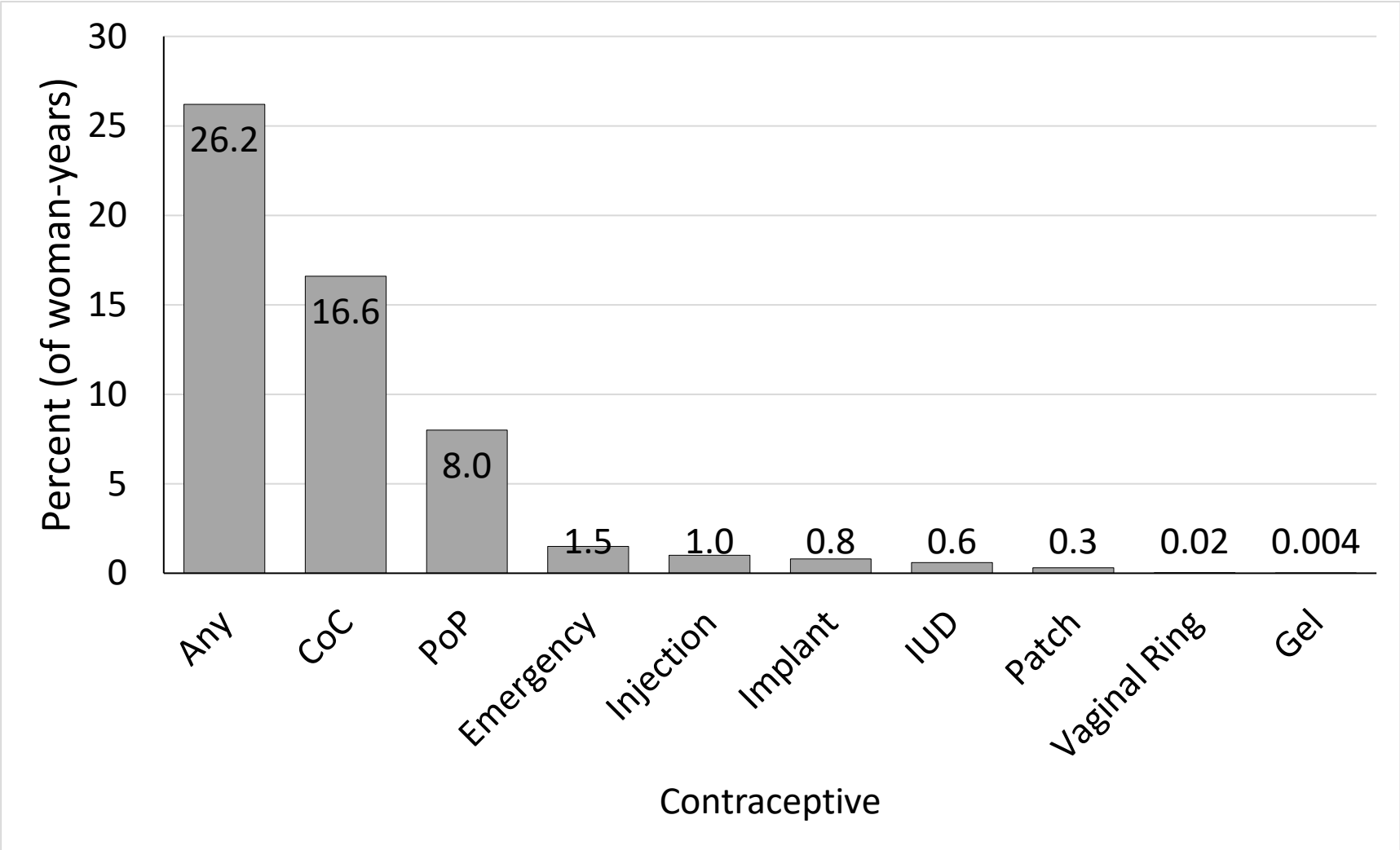
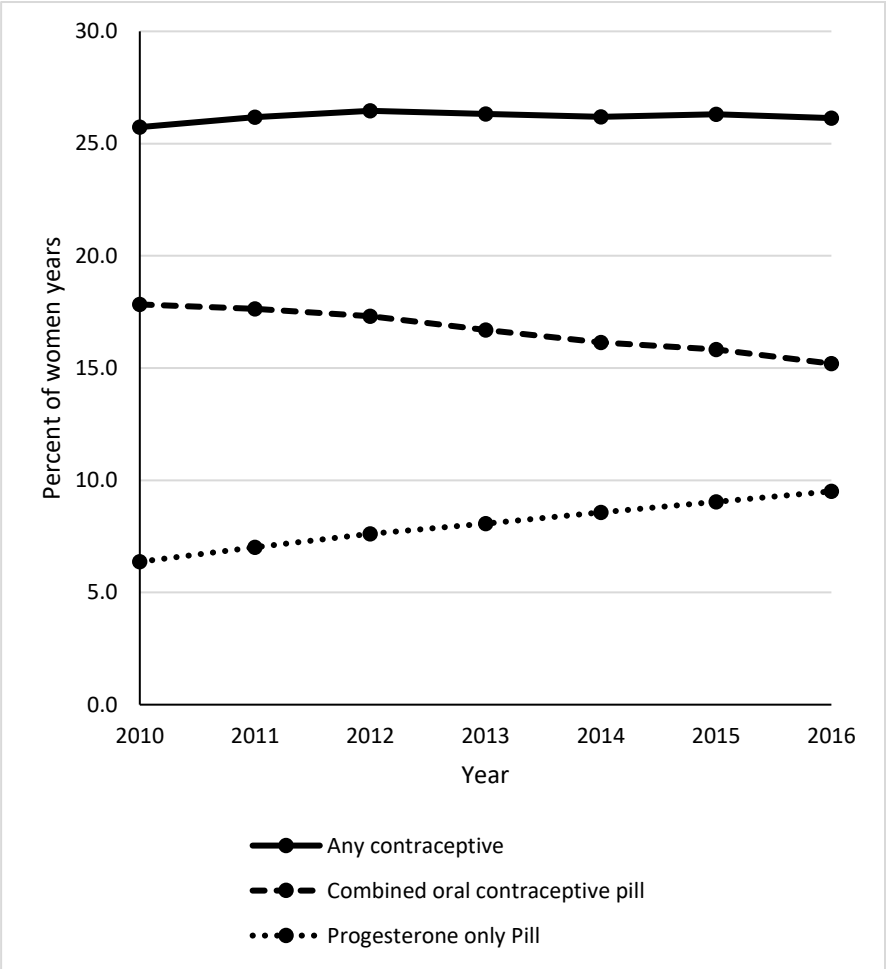

30
25
20
15
10
5
0
Percent (of woman-years)
26.2
16.6
8.0
1.5
1.0
0.8
0.6
0.3
0.02
0.004
Any
CoC
PoP
Emergency
Injection
Implant
IUD
Patch
Vaginal Ring
Gel
Contraceptive

Figure 2


30.0
25.0
20.0
15.0
10.0
5.0
0.0
Percent of women years
2010
2011
2012
2013
2014
2015
2016
Year
Any contraceptive
Combined oral contraceptive pill
Progesterone only Pill

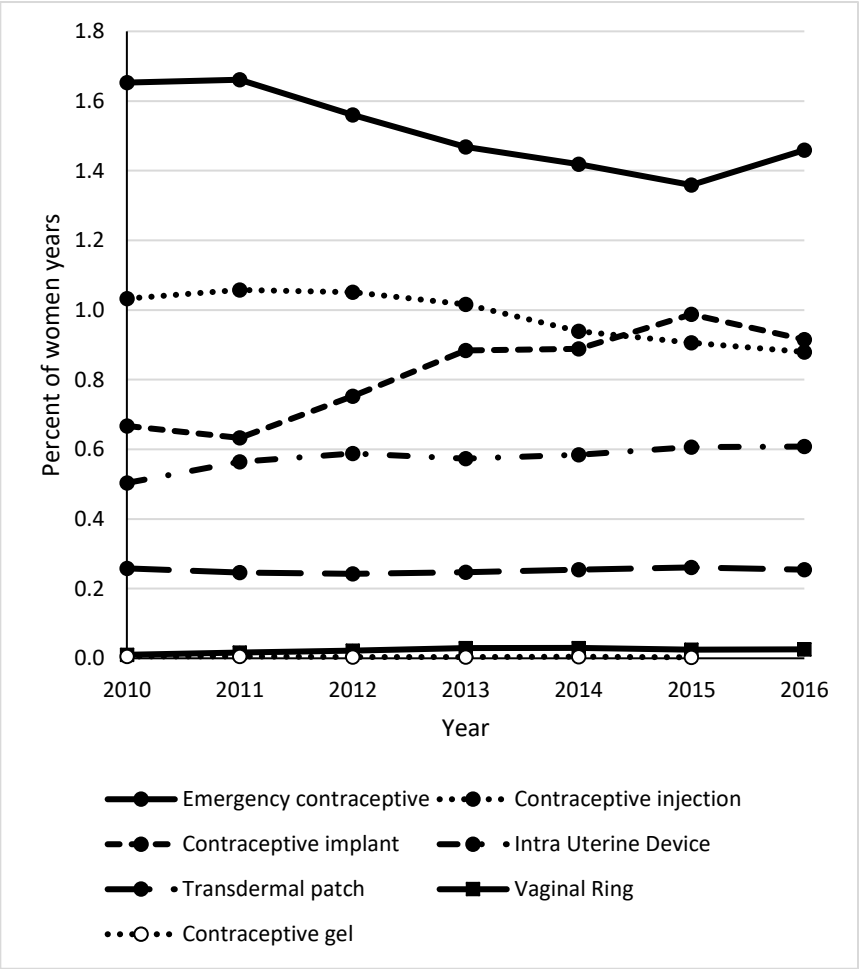
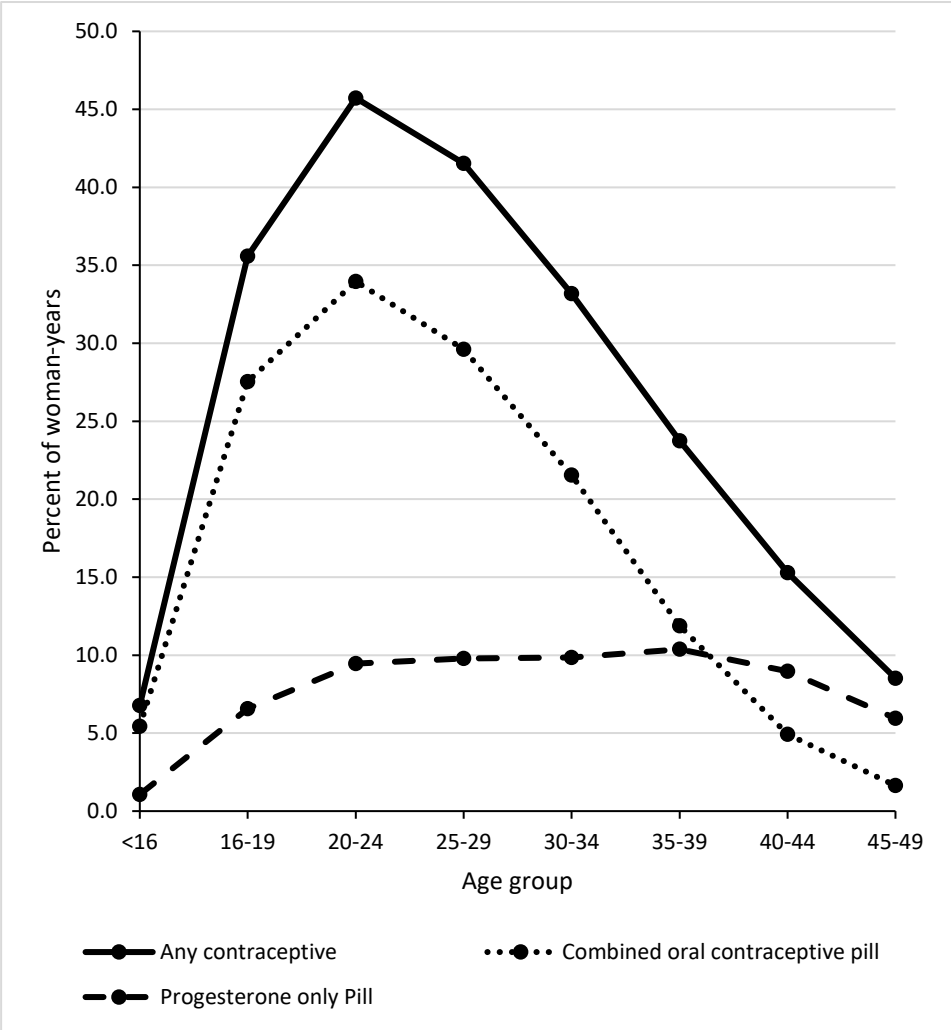

1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Percent of women years
2010
2011
2012
2013
2014
2015
2016
Year
Emergency contraceptive
Contraceptive injection
Contraceptive implant
Intra Uterine Device
Transdermal patch
Vaginal Ring
Contraceptive gel

Figure 3


50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Percent of woman-years
<16
16-19
20-24
25-29
30-34
35-39
40-44
45-49
Age group
Any contraceptive
Combined oral contraceptive pill
Progesterone only Pill

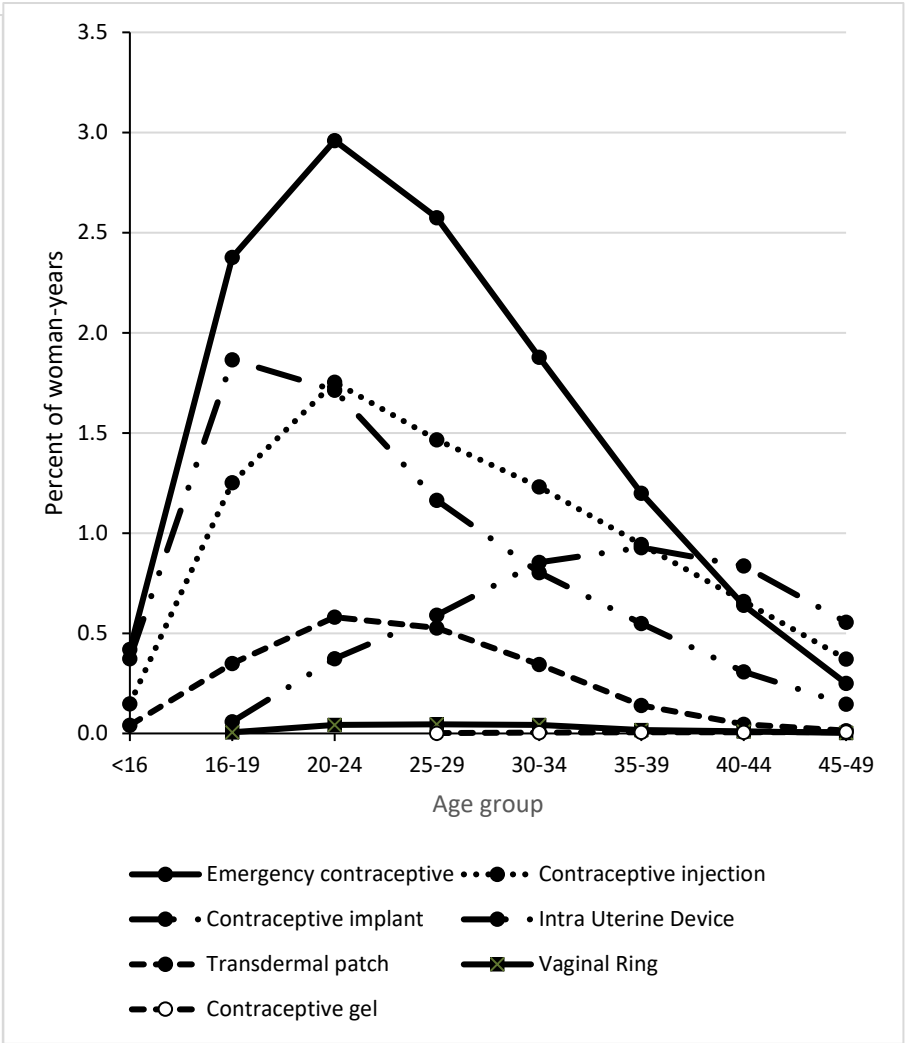

3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Percent of woman-years
<16
16-19
20-24
25-29
30-34
35-39
40-44
45-49
Age group
Emergency contraceptive
Contraceptive injection
Contraceptive implant
Intra Uterine Device
Transdermal patch
Vaginal Ring
Contraceptive gel

Figure 1 Percent of woman-years with any and specific, contraceptives dispensed 2010-2016

Figure 2 Percent of woman-years with any contraception, and specific methods of contraception dispensed each year 2010-2016

Figure 3 Percent of woman-years in each age group with any, and specific methods of contraception dispensed 2010-2016

Supplemental Online Material

Supplemental Table 1 Percent of prescriptions for CoC, PoP and IUD/S dispensed (2010-2016) by hormonal content

Contraceptive	**Percent of prescriptions dispensed**
Combined oral contraceptive	
Estradiol and nomegestrol	0.0
Ethinylestradiol and desogestrel	6.2
Ethinylestradiol and drospirenone	19.1
Ethinylestradiol and gestodene	4.2
Ethinylestradiol and levonorgestrel	54.4
Ethinylestradiol and norethisterone	3.1
Ethinylestradiol and norethisterone acetate	1.8
Ethinylestradiol and norgestimate	10.9
Mestranol and norethisterone	0.0
Estradiol valerate and dienogest	0.2
Progesterone only pill	
Desogestrel	88.6
Etynodiol	1.4
Levonorgestrel	0.6
Norethisterone	9.4
Intra Uterine Device/System	
Copper	16.1
Levonorgestrel	83.9

Supplemental Table 2 Number, percent of woman-years and adjusted prevalence rate ratios for contraceptive methods dispensed 2010-2016

	Year											
	2010		**2011**		**2012**		**2013**		**2014**		**2015**		**2016**	
Contraceptive	**n (%)**		**n (%)**	**Adj. RR (95% CI)**	**n (%)**	**Adj. RR (95% CI)**	**n (%)**	**Adj. RR (95% CI)**	**n (%)**	**Adj. RR (95% CI)**	**n (%)**	**Adj. RR (95% CI)**	**n (%)**	**Adj. RR (95% CI)**
CoC	80,718 (17.8)	Ref.	80,510 (17.6)	0.99 (0.98-0.99)	79,693 (17.3)	0.97 (0.97-0.98)	77,507 (16.7)	0.95 (0.94-0.95)	75,638 (16.1)	0.92 (0.92-0.93)	74,936 (15.8)	0.91 (0.91-0.92)	72,826 (15.2)	0.88 (0.88-0.89)
PoP	28,823 (6.4)	Ref.	32,052 (7.0)	1.05 (1.05-1.06)	35,028 (7.6)	1.10 (1.09-1.10)	37,447 (8.1)	1.13 (1.12-1.13)	40,139 (8.6)	1.16 (1.16-1.17)	42,773 (9.0)	1.20 (1.19-1.21)	45,549 (9.5)	1.23 (1.22-1.24)
Emergency	7,484 (1.7)	Ref.	7,586 (1.7)	1.00 (0.99-1.02)	7,183 (1.6)	0.98 (0.96-0.99)	6,814 (1.5)	0.95 (0.94-0.96)	6,649 (1.4)	0.94 (0.93-0.95)	6,435 (1.4)	0.92 (0.91-0.93)	6,993 (1.5)	0.95 (0.93-0.96)
Injection	4,674 (1.0)	Ref.	4,830 (1.1)	1.01 (1.00-1.02)	4,841 (1.1)	1.01 (0.99-1.02)	4,716 (1.0)	0.99 (0.98-1.00)	4,403 (0.9)	0.96 (0.95-0.97)	4,290 (0.9)	0.95 (0.93-0.96)	4,216 (0.9)	0.94 (0.92-0.95)
Implant	3,019 (0.7)	Ref.	2,890 (0.6)	0.98 (0.96-1.00)	3,464 (0.8)	1.04 (1.02-1.06)	4,101 (0.9)	1.11 (1.09-1.13)	4,165 (0.9)	1.10 (1.09-1.13)	4,676 (1.0)	1.16 (1.14-1.18)	4,387 (0.9)	1.12 (1.11-1.14)

IUD/S	2279 (0.5)	Ref.	2576 (0.6)	1.04 (1.02-1.06)	2706 (0.6)	1.06 (1.03-1.08)	2663 (0.6)	1.05 (1.02-1.07)	2740 (0.6)	1.05 (1.03-1.07)	2874 (0.6)	1.07 (1.05-1.09)	2914 (0.6)	1.06 (1.04-1.09)
Patch	1,169 (0.3)	Ref.	1,125 (0.2)	0.98 (0.96-1.00)	1,117 (0.2)	0.97 (0.95-1.00)	1,148 (0.2)	0.97 (0.95-1.00)	1,195 (0.3)	0.98 (0.96-1.01)	1,236 (0.3)	0.99 (0.97-1.01)	1,222 (0.3)	0.98 (0.96-1.01)
Vaginal Ring	46 (0.0)	Ref.	74 (0.0)	1.08 (1.02-1.13)	100(0.0)	1.15 (1.08-1.22)	136 (0.0)	1.22 (1.15-1.30)	140 (0.0)	1.21 (1.14-1.29)	117 (0.0)	1.14 (1.07-1.21)	123 (0.0)	1.12 (1.05-1.20)
Gel	25 (0.0)	Ref.	25 (0.0)	0.90 (0.80-1.00)	15 (0.0)	0.92 (0.83-1.02)	17 (0.0)	0.96 (0.86-1.07)	21 (0.0)	0.93 (0.82-1.05)	27 (0.0)	0.75 (0.64-0.88)		

Supplemental Table 3 Number, percent of woman-years and adjusted prevalence rate ratios for contraceptive methods dispensed across age groups

Contraceptive	Age group															
	<16		**16-19**		**20-24**		**25-29**		**30-34**		**35-39**		**40-44**		**45+**	
	n (%)	**Adj. RR (95% CI)**	**n (%)**	**Adj. RR (95% CI)**	**n (%)**		**n (%)**	**Adj. RR (95% CI)**	**n (%)**	**Adj. RR (95% CI)**	**n (%)**	**Adj. RR (95% CI)**	**n (%)**	**Adj. RR (95% CI)**	**n (%)**	**Adj. RR (95% CI)**
CoC	16,698 (5.4)	0.34 (0.34-0.35)	81,933 (27.5)	0.86 (0.85-0.86)	134,884 (34.0)	Ref	130,561 (29.6)	0.88 (0.88-0.89)	96,012 (21.6)	0.69 (0.68-0.69)	51,307 (11.9)	0.48 (0.47-0.48)	22,656 (4.9)	0.32 (0.32-0.32)	7,777 (1.6)	0.22 (0.22-0.22)
PoP	3,285 (1.1)	0.42 (0.41-0.42)	19,533 (6.6)	0.83 (0.82-0.84)	37,56 (9.5)	Ref	43,184 (9.8)	1.04 (1.03-1.05)	43,858 (9.8)	1.03 (1.02-1.04)	44,826 (10.4)	1.05 (1.04-1.06)	41,315 (9.0)	0.96 (0.95-0.97)	28,249 (5.9)	0.81 (0.81-0.82)
Emergency	1,288 (0.4)	0.49 (0.48-0.50)	7,071 (2.4)	0.92 (0.91-0.93)	11,754 (3.0)	Ref	11,353 (2.6)	0.94 (0.93-0.96)	8,366 (1.9)	0.83 (0.82-0.84)	5,182 (1.2)	0.70 (0.69-0.71)	2,944 (0.6)	0.56 (0.55-0.57)	1,186 (0.2)	0.41 (0.40-0.42)

Injection	457 (0.1)	0.49 (0.47-0.51)	3,723 (1.3)	0.89 (0.87-0.90)	6,965 (1.8)	Ref	6,466 (1.5)	0.94 (0.93-0.96)	5,481 (1.2)	0.87 (0.86-0.89)	4,077 (0.9)	0.80 (0.78-0.82)	3,037 (0.7)	0.72 (0.70-0.73)	1,764 (0.4)	0.62 (0.60-0.63)
Implant	1,146 (0.4)	0.57 (0.57-0.60)	5,550 (1.9)	1.02 (1.02-1.05)	6,805 (1.7)	Ref	5,135 (1.2)	0.85 (0.85-0.88)	3,579 (0.8)	0.74 (0.74-0.77)	2,371 (0.5)	0.65 (0.65-0.67)	1,420 (0.3)	0.53 (0.53-0.56)	696 (0.1)	0.42 (0.42-0.45)
IUD/S	354 (0.1)	0.57 (0.55-0.59)			1,483 (0.4)	Ref	2,601 (0.6)	1.17 (1.15-1.20)	3,808 (0.9)	1.34 (1.31-1.37)	4,011 (0.9)	1.37 (1.35-1.40)	3,854 (0.8)	1.33 (1.30-1.35)	2,641 (0.6)	1.15 (1.12-1.18)
Patch	128 (0.0)	0.51 (0.48-0.53)	1,038 (0.3)	0.87 (0.85-0.90)	2,306 (0.6)	Ref	2,319 (0.5)	0.96 (0.94-0.99)	1,534 (0.3)	0.85 (0.82-0.88)	606 (0.1)	0.67 (0.65-0.70)	214 (0.0)	0.51 (0.48-0.53)	67 (0.0)	0.38 (0.36-0.41)
Vaginal Ring	37 (0.0)	0.70 (0.64-0.76)			171 (0.0)	Ref	201 (0.0)	1.02 (0.96-1.09)	192 (0.0)	0.99 (0.92-1.06)	76 (0.0)	0.83 (0.76-0.91)	47 (0.0)	0.67 (0.59-0.75)	12 (0.0)	0.50 (0.42-0.59)
Gel	25 (0.0)	Ref.							18 (0.0)	1.11 (0.92-1.34)	25 (0.0)	1.30 (1.12-1.50)	28 (0.0)	1.26 (1.05-1.51)	34 (0.0)	1.39 (1.20-1.60)

Supplemental Table 4 Number, percent of woman-years and adjusted prevalence rate ratios for contraceptive methods dispensed in rural general practices compared to urban practices

	Practice urban/rural			
	Urban		**Rural**	
Contraceptive	**n (%)**		**n (%)**	**Adj. RR (95% CI)**
CoC	408,823 (16.5)	Ref.	133,005 (17.3)	1.05 (1.04-1.05)
PoP	204,399 (8.2)	Ref.	57,412 (7.5)	0.94 (0.93-0.95)
Emergency	38,947 (1.6)	Ref.	10,197 (1.3)	0.93 (0.92-0.94)
Injection	23,609 (1.0)	Ref.	8,361 (1.1)	1.03 (1.01-1.05)
Implant	19,126 (0.8)	Ref.	7,576 (1.0)	1.15 (1.13-1.16)
IUD/S	12,343 (0.5)	Ref.	6,409 (0.8)	1.20 (1.18-1.21)
Patch	6,110 (0.3)	Ref.	2,102 (0.3)	1.09 (1.06-1.13)
Vaginal Ring	537 (0.0)	Ref.	199 (0.0)	1.05 (0.96-1.14)
Gel	102 (0.0)	Ref.	28 (0.0)	0.94 (0.78-1.12)

Supplemental Table 5 Number, percent of woman-years and adjusted prevalence rate ratios for contraceptive methods dispensed by general practice size

	Practice size									
	0 to 2,500		**2,501 to 5,000**		**5,001 to 7,500**		**7,501 to 10,000**		**Over 10,000**	
Contraceptive	**n (%)**	**Adj. RR (95% CI)**	**n (%)**	**Adj. RR (95% CI)**	**n (%)**	**Adj. RR (95% CI)**	**n (%)**		**n (%)**	**Adj. RR (95% CI)**
CoC	23,236 (17.9)	1.07 (1.05-1.08)	144,867 (17.5)	1.06 (1.05-1.07)	145,978 (16.6)	1.03 (1.02-1.03)	141,431 (16.0)	Ref.	86,316 (16.2)	1.01 (1.00-1.02)
PoP	9,368 (7.2)	0.92 (0.90-0.94)	64,666 (7.8)	0.96 (0.95-0.97)	71,054 (8.1)	0.98 (0.97-0.98)	74,805 (8.5)	Ref.	41,918 (7.9)	0.94 (0.93-0.95)
Emergency	1,784 (1.4)	1.05 (1.03-1.06)	12,863 (1.6)	1.06 (1.05-1.08)	13,810 (1.6)	1.07 (1.06-1.09)	12,903 (1.5)	Ref.	7,784 (1.5)	1.01 (0.99-1.04)
Injection	1,632 (1.3)	1.11 (1.07-1.15)	9,647 (1.2)	1.08 (1.06-1.11)	8,834 (1.0)	1.03 (1.01-1.05)	8,059 (0.9)	Ref.	3,798 (0.7)	0.91 (0.89-0.94)
Implant	975 (0.8)	0.95 (0.92-0.98)	7,602 (0.9)	1.05 (1.03-1.06)	6,502 (0.7)	0.99 (0.97-1.00)	6,548 (0.7)	Ref.	5,075 (1.0)	1.15 (1.13-1.16)
IUD/S	411 (0.3)	0.76 (0.73-0.79)	4,705 (0.6)	0.96 (0.94-0.97)	4,920 (0.6)	0.95 (0.94-0.96)	5,743 (0.7)	Ref.	2,973 (0.6)	1.01 (0.99-1.03)
Patch	358 (0.3)	1.01 (0.94-1.08)	2,412 (0.3)	1.03 (1.00-1.07)	1,852 (0.2)	0.96 (0.92-0.99)	2,105 (0.2)	Ref.	1,485 (0.3)	1.09 (1.05-1.14)
Vaginal Ring	28 (0.0)	1.01 (0.85-1.20)	165 (0.0)	1.00 (0.90-1.10)	220 (0.0)	1.05 (0.96-1.17)	171 (0.0)	Ref.	152 (0.0)	1.12 (1.01-1.24)
Gel	38 (0.0)	1.04 (0.86-1.24)			38 (0.0)	1.06 (0.89-1.26)	38(0.0)	Ref.	16 (0.0)	0.95 (0.78-1.15)

Supplemental Table 6 Number, percent of women years and adjusted rate ratios for dispensed contraceptive prescriptions by general practice area deprivation quintiles

	Practice address NIMDM2017 Quintile									
	1 Most deprived		**2**		**3**		**4**		**5 Least deprived**	
Contraceptive	**n (%)**		**n (%)**	**Adj. RR (95% CI)**	**n (%)**	**Adj. RR (95% CI)**	**n (%)**	**Adj. RR (95% CI)**	**n (%)**	**Adj. RR (95% CI)**
CoC	191,016 (16.4)	Ref.	124,152 (17.0)	1.02 (1.01-1.03)	89,009 (16.6)	1.02 (1.01-1.03)	94,503 (17.0)	1.03 (1.02-1.04)	43,149 (16.0)	1.03 (1.02-1.04)
PoP	89,19 (7.7)	Ref.	58,398 (8.0)	1.05 (1.04-1.06)	44,129 (8.2)	1.08 (1.07-1.09)	47,640 (8.6)	1.10 (1.09-1.11)	22,448 (8.3)	1.09 (1.08-1.11)
Emergency	18,344 (1.6)	Ref.	11,249 (1.5)	1.05 (1.03-1.6)	8,138 (1.5)	1.06 (1.05-1.08)	8,448 (1.5)	1.07 (1.05-1.08)	2,965 (1.1)	1.01 (0.99-1.04)
Injection	10,626 (0.9)	Ref.	8,149 (1.1)	1.10 (1.08-1.12)	5,042 (0.9)	1.06 (1.04-1.09)	5,923 (1.1)	1.11 (1.09-1.14)	2,230 (0.8)	1.07 (1.03-1.11)
Implant	11,241 (1.0)	Ref.	6,794 (0.9)	0.98 (0.97-0.99)	3,823 (0.7)	0.88 (0.87-0.80)	3,713 (0.7)	0.89 (0.87-0.90)	1,131 (0.4)	0.81 (0.79-0.83)
IUD/S	5,618 (0.5)	Ref.	4,982 (0.7)	1.08 (1.07-1.10)	2,665 (0.5)	0.96 (0.94-0.98)	3,340 (0.6)	1.04 (1.02-1.06)	2,147 (0.8)	1.16 (1.14-1.19)
Patch	3,746 (0.3)	Ref.	1,860 (0.3)	0.93 (0.89-0.96)	1,110 (0.2)	0.88 (0.84-0.91)	1,115 (0.2)	0.88 (0.84-0.92)	381 (0.1)	0.84 0.79-0.89)
Vaginal Ring	256 (0.0)	Ref.	170 (0.0)	1.02 (0.93-1.12)	58 (0.0)	0.85 (0.75-0.97)	163 (0.0)	1.12 (1.02-1.24)	89 (0.0)	1.16 (1.01-1.33)
Gel	55 (0.0)	Ref.	12 (0.0)	0.78 (0.63-0.96)	19 (0.0)	0.92 (0.73-1.17)	23 (0.0)	0.99 (0.81-1.22)	21 (0.0)	1.20 (0.95-1.51)